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IS : 2972 (Part III) - 1979

(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR TEXTILE MOTORS

PART III SPINNING FRAME MOTORS

(*First Revision*)

UDC 621·313·333·2·025·3 : 677·052·3·5

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August 1980

Indian Standard

SPECIFICATION FOR TEXTILE MOTORS

PART III SPINNING FRAME MOTORS

(First Revision)

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Indian Standard

SPECIFICATION FOR TEXTILE MOTORS

PART III SPINNING FRAME MOTORS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part III) (First Revision) was adopted by the Indian Standards Institution on 27 December 1979, after the draft finalized by the Rotating Machinery Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The motors required for spinning frame have several things in common, such as the performance requirements and methods of testing covered in IS : 325-1978*. These motors have some special features, such as starting with smooth acceleration. This has been taken into account in the preparation of this standard.

0.3 The selection of the spinning frame motor depends upon the size of the ring frame, number of spindles, gauge, ring diameter, lift, spindle speed, type and count of yarn, type of builder motion and drafting system. This standard is, therefore, prepared with a view to specifying a series of motors which may adequately meet the various requirements of the spinning frame and also to ensure interchangeability of motors of a particular make with that of another.

0.4 Standard foot-mounted motors have been specified in this standard. The various output ratings have been assigned to standard frame sizes as outlined in IS : 1231-1974†.

0.5 The variable speed (commutator type) motors have been excluded from this standard. The position will be reviewed at a later date and the possibility of bringing out a standard for these motors would then be considered.

0.6 This standard covers the 4-pole and 6-pole single-speed motors and also 4/6 pole and 6/8-pole two-speed spinning frame motors that are at present very widely used in this country.

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*Specification for three-phase induction motors (*fourth revision*).

†Dimensions of three-phase foot-mounted induction motors (*second revision*).

0.7 This standard was first issued in 1964 and covered the motors of output ratings from 3·7 to 15 kW for driving spinning frames, such as slubbing, intermediate, roving and ring frame for spinning cotton yarn. This revision has been prepared with a view to expanding its scope to cover motors of output ratings up to 22 kW and the application is extended to driving spinning frames for heavy fabrics, such as woollen and canvas.

0.7.1 The original standard covered motors with class A and E insulation. In this revision motors with class B and F insulations are added. At the same time, class A motors have not been deleted as some motor manufacturers in small scale sector are still manufacturing these types of motors; however, it has not been felt necessary to specify the relationship between output and frame size for class A motors. Frame assignments applicable earlier to class A, have been revised and made applicable to class E and class B insulated motors.

0.7.2 Because of space restriction, the overall dimensions of the motor assume great importance. Therefore maximum overall dimensions are also specified in this revision.

0.8 The starting torque and the speed-torque characteristics of the spinning frame motor is typical since it should be neither too high nor too low. If it is too high, the acceleration will be rapid and there will be snatch and breakup of the yarn. If it is too low, the tension of the yarn is insufficient and as such the yarn gets entangled and causes breakage. The drive, therefore, is to be reasonably smooth and slow to avoid any breaking even under a widely varying condition of inertia and friction. These factors have been taken into consideration in specifying the torque values. The speed-torque curves of the motor have to be matched with that of the ring frame for satisfactory operation.

0.9 To ensure satisfactory installation and maintenance of induction motors, the recommendations contained in IS : 900-1965* shall be followed.

0.10 This standard is one of a series of Indian Standard specifications for motors required by the textile industry. Other specifications issued in the series are:

IS : 2972 (Part I)-1979 Textile motors: Part I Loom motors (*first revision*)

IS : 2972 (Part II)-1979 Textile motors: Part II Card motors (*first revision*)

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*Code of practice for installation and maintenance of induction motors (*revised*).

0.11 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part III) covers squirrel-cage three-phase induction motors for driving textile spinning frames on system voltage not exceeding 650 V and having rated outputs from 3·7 to 22 kW.

1.2 This standard covers the output frame assignments for 4-pole and 6-pole single-speed motors and 4/6 and 6/8 pole two-speed motors with class E and B or F insulations for spinning frame motors. However, motors of smaller outputs in smaller frame numbers having speed-torque characteristics outlined in 12 may be used for other spinning frames. In case of two-speed motors there is a scope for obtaining higher outputs than those assigned in Table 3. This shall be a matter of agreement between the manufacturer and the purchaser.

1.3 The motors covered by this specification have either Class 'A', 'E' and 'B', or 'F' insulation with their associated temperature-rises as outlined, in **12** of IS : 325-1978†.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS : 1885 (Part XXXV)-1973‡ shall apply.

3. SITE CONDITIONS

3.1 For the purpose of this standard, the normal site conditions shall be in accordance with **3** of IS : 325-1978†.

4. TYPES OF ENCLOSURES

4.1 The degree of protection to be provided by enclosures shall be IP44 or superior (totally-enclosed) in accordance with IS : 4691-1968§.

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*Rules for rounding off numerical values (*revised*).

†Specification for three-phase induction motors (*fourth revision*).

‡Electrotechnical vocabulary: Part XXXV Rotating machiney.

§Degrees of protection provided by enclosures for rotating electrical machinery.

5. METHOD OF COOLING

5.1 The method of cooling shall be ICO141 (totally-enclosed with fan cooling) in accordance with IS : 6362-1971*.

NOTE 1 — The cowl inlet and outlet of the motor shall be of such a construction as to minimize blockage due to fly.

NOTE 2 — In case of likelihood of blockage of ventilation, the motors of higher class of insulation are used or restricted temperature-rise limits may be resorted to.

NOTE 3 — For added safety ~~and~~ protection, three number PTC thermistors embedded in stator windings may be provided to take care of abnormal condition during the operation.

6. PREFERRED VOLTAGES, FREQUENCY, OUTPUT AND SPEED

6.1 Preferred Voltage — The preferred rated voltage shall be 415 V.

6.2 Preferred Frequency — The preferred rated frequency shall be 50 Hz.

6.3 Preferred Speeds — The preferred synchronous speeds in rev/min shall be 1 500, 1 000 and 750 corresponding to 4, 6, 8-pole motors respectively.

7. STANDARD FRAME NUMBER AND DIMENSIONS

7.1 The fixing and overall dimensions of the motors shall be according to Table 1 read with Fig. 1.

7.2 The output-frame assignment of the motors shall be according to Tables 2 and 3.

7.3 Position of Terminal Box — The terminal box should have its centre line lying in a sector ranging from the top to 10° below the horizontal centre line of the motor on the right-hand side, when looking at the driving end of motor.

8. DUTY AND RATING

8.1 For the purpose of this standard, only duty type S1 (continuous duty) and S8 (continuous duty with periodic speed change) shall be applicable (for details, *see* **9.2** of IS : 4722-1968†).

9. EARTHING

9.1 Earthing of the motor shall be done in accordance with the relevant provisions of IS : 3043-1966‡.

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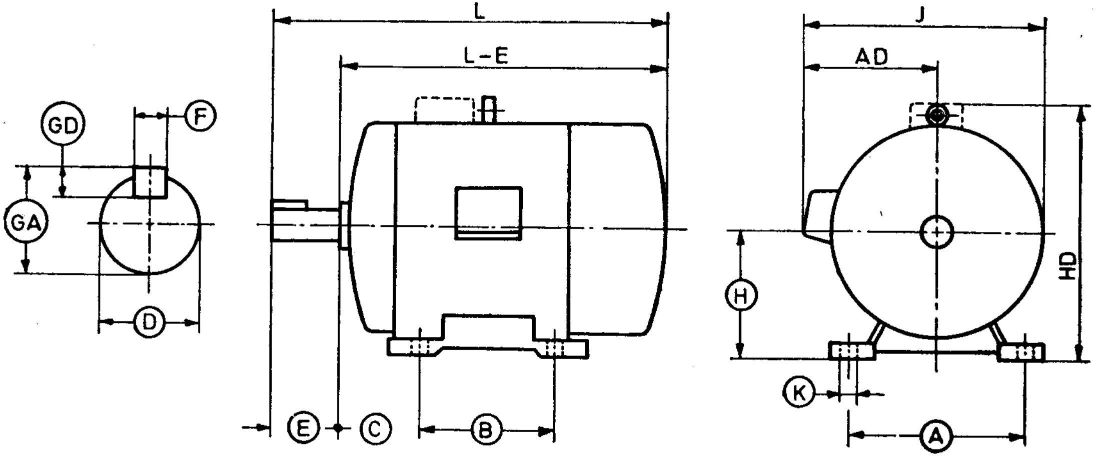
*Designation of methods of cooling for rotating electrical machines.

†Specification for rotating electrical machines.

‡Code of practice for earthing.



All dimensions in millimetres.

FIG. 1 FOOT-MOUNTED SPINNING FRAME MOTORS

TABLE 1 DIMENSIONS OF STANDARD FOOT-MOUNTED SPINNING FRAME MOTORS (LR)

(*Clause* 7.1)

FRAME NUMBER	FIXING DIMENSIONS						SHAFT AND KEY DIMENSIONS						MAXIMUM OVERALL DIMENSION			
	H		*A*	*B*	*C*	*K*	*D*		*E*	*F*	*GD*	*GA*	*L—E*	*J*	*HD*	*AD*
	Nom	Tol					Nom	Tol								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
112 M	112	– 0·5	190	140	70	12	28	$\mathrm{j6}^{+0\cdot009}_{-0\cdot004}$	60	8	7	31	380	340	320	205
132 S	132	– 0·5	216	140	89	12	38	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	80	10	8	41	425	390	365	230
132 M	132	– 0·5	216	178	89	12	38	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	80	10	8	41	465	390	365	230
160 M	160	– 0·5	254	210	108	15	42	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	110	12	8	45	560	440	420	258
160 L	160	– 0·5	254	254	108	15	42	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	110	12	8	45	605	440	420	258
180 M	180	– 0·5	279	241	121	15	48	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	110	14	9	51·5	630	485	460	292
180 L	180	– 0·5	279	279	121	15	48	$\mathrm{k6}^{+0\cdot018}_{+0\cdot002}$	110	14	9	51·5	670	485	460	292
200 L	200	– 0·5	318	305	133	19	55	$\mathrm{m6}^{+0\cdot030}_{+0\cdot011}$	110	16	10	59	720	590	555	352
225 S	225	– 0·5	356	286	149	19	60	$\mathrm{m6}^{+0\cdot030}_{+0\cdot011}$	140	18	11	64	760	600	580	362

NOTE — The overall dimensions *W* and *AD* are up to the outermost periphery of the motor, including cooling ribs when provided.

TABLE 2 FRAME ASSIGNMENTS FOR SINGLE-SPEED SPINNING FRAME MOTORS, 4 AND 6 POLES WITH CLASS OF INSULATION E, B OR F, DEGREE OF PROTECTION IP44 OR SUPERIOR AND METHOD OF COOLING ICO141

(*Clauses* 7.2 *and* 14.1)

Frame Number	Output Rating for Synchronous Speed	
	1 500 rev/min	1 000 rev/min
(1)	(2)	(3)
	kW	kW
112 M	3·7	—
132 S	5·5	—
132 M	7·5	3·7 and 5·5
160 M	9·3 and 11	7·5
160 L	15	9·3 and 11
180 M	18·5	—
180 L	22	15

TABLE 3 FRAME ASSIGNMENT FOR TWO-SPEED SPINNING FRAME MOTORS 4/6 POLES AND 6/8 POLES WITH CLASS E, B OR F INSULATION, DEGREE OF PROTECTION IP44 OR SUPERIOR AND METHOD OF COOLING ICO141

(*Clauses* 1.2 *and* 7.2)

Frame Number	Output Rating for Synchronous Speed	
	1 500/1 000 rev/min	1 000/750 rev/min
(1)	(2)	(3)
	kW	kW
160 M	5·5/3·7	3·7/2·8
160 L	7·5/5·0	5·5/4·0
180 M	9·3/5·5, 11/7·5	—
180 L	15/11	7·5/5·5
200 M	—	—
200 L	—	9·3/7·0
225 S	—	11/8·2

10. OVERLOAD

10.1 Momentary Excess Torque — The motors shall, whatever their type of construction, be capable of withstanding for 15 seconds without stalling or abrupt change in speed, an excess torque of 60 percent of their rated torque, the torque being increased gradually, the voltage and frequency being maintained at their rated values.

10.2 Sustained Overloads — Motors rated in accordance with this standard are not capable of carrying sustained overloads.

11. LIMITS OF VIBRATION

11.1 Unless otherwise specified, the double amplitude of vibrations for the motors shall be within the normal level limits specified in IS : 4729-1968*.

12. PERFORMANCE

12.1 The following values of the various torque characteristics for spinning frame motors have been stipulated taking into consideration their performance requirements when started at full rated voltage (*see* **0.8**).

a) Breakaway torque, 150 to 200 percent of the full load torque; and

b) Pull out torque, 200 to 275 percent of the full load torque.

13. EFFICIENCY AND POWER FACTOR

13.1 Efficiency — If a statement of efficiency is required, the purchaser shall specify at the time of enquiry and load to which the statement shall apply. The method of arriving at the efficiency shall be as given in IS : 4889-1968†.

13.2 Power Factor — If a statement of power factor is required for an induction motor, the purchaser shall specify at the time of enquiry the loads on which the statement is to be based.

14. TOLERANCE

14.1 Unless otherwise specified, tolerances shall be in accordance with Table 2 of IS : 325-1978‡. Where a tolerance is stated in only one direction, the tolerance in the other direction is considered unimportant.

15. TERMINAL MARKINGS

15.1 Terminal markings shall be in accordance with IS : 4728-1975§.

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*Measurement and evaluation of vibration of rotating electrical machines.

†Method of determination of efficiency of rotating electrical machines.

‡Specification for three-phase induction motors (*fourth revision*).

§Terminal marking and direction of rotation for rotating electrical machinery (*first revision*).

16. RATING PLATE

16.1 A rating plate stating the following shall be supplied with each motor:

a) Reference of this standard, that is, ISS 2972 (Part III);
b) Type of motor, that is, induction motor;
c) Name of manufacturer;
d) Manufacturer's number and frame reference;
e) Type of duty;
f) Class of insulation;
g) Frequency in Hz;
h) Number of phases;
j) Rated output in kW;
k) Rated voltage and winding connections;
m) Current approximate, in amperes at rated output;
n) Speeds in revolutions per minute, at rated output; and
p) Ambient temperature when above 40°C.

16.1.1 The motors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

17. INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

17.1 The general information to be furnished when enquiring for and ordering an electrical motor is given in Appendix A.

18. TESTS

18.1 General — The tests specified in **18.3** shall normally be carried out at manufacturer's works.

18.2 Test Certificates

18.2.1 Unless otherwise specified when inviting tenders, the purchaser, if so devised by manufacturer, may accept manufacturer's certificate as evidence of the compliance of the motor with the requirements (*see* **7, 10** *and* **12**) of this standard together with the type test (*see* **18.3.1.1**) certificate on a motor identical in essential details with the one purchased, together with the routine test certificate on each individual motor. In the case when a batch of 20 or more similar motors is supplied on one order, type tests, as specified, shall be made on one of these motors, if the purchaser so requires.

18.2.2 Certificates of routine tests shall show that the motor purchased has been run and has been found to be electrically and mechanically sound and in working order in all particulars.

18.2.3 If so specified when inviting tenders, tests shall be carried out at the manufacturer's works in the presence of the purchaser or his representative to ensure that the motor complies in every respect with the requirements of **7**, **10**, **12**, and **18** and also to ascertain that the efficiency conforms to the guarantee, if any.

18.2.4 Certificates of all type tests together with a record of any alterations, whether essential or not, which have been made to the motor since the type tests were carried out, shall be kept available by the manufacturer for inspection.

18.3 Classification of Tests

18.3.1 *Type Tests* — The following shall constitute the type tests:

a) Measurement of stator resistance;

b) No-load running of motor and reading of voltage, current, power input and speed;

c) Reduced voltage running up test at no-load to check the ability of motor to run up to full speed on no-load in each direction of rotation with $1/\sqrt{3}$ of the rated line voltage applied to the motor;

d) Locked-rotor readings of voltage, current, power input and torque of squirrel cage motors;

NOTE — This test may be made at a reduced voltage.

e) Full-load reading of voltage, current, power input and slip;

f) Momentary over-load test;

g) Temperature-rise test (*see* **22** of IS : 325-1978*);

h) High-voltage test (*see* **23** of IS : 325-1978*);

j) Insulation-resistance test both before and after the high-voltage test (*see* **24** of IS : 325-1978*).

NOTE — For test methods covered in this standard, reference may be made to IS : 4029-1967†.

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*Specification for three-phase induction motors (*fourth revision*).

†Guide for testing three-phase induction motors.

18.3.1.1 It is recommended that reports of type tests be made in the form given in Appendix B.

18.3.2 *Routine Test* — The following shall constitute the routine tests:

a) Insulation-resistance test (before high-voltage test only);

b) High-voltage test (*see* **23** of IS : 325-1978*);

c) No-load running of motor and reading of current in the three phases and voltage;

d) Locked-rotor readings of voltage, current and power input at a suitable voltage; and

e) Reduced voltage running up test at no-load to check the ability of the motor to run up to full speed on no-load in each direction of rotation with $1/\sqrt{3}$ of the rated line voltage applied to the stator terminals.

APPENDIX A

(*Clause* 17.1)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

When enquiring for and ordering an electric motor to comply with this standard, the following particulars should be supplied:

1) Site and operating conditions;
2) Reference to this standard, that is, Ref ISS 2972 (Part III);
3) The type of enclosure;
4) The type of duty;
5) Frequency in Hz;
6) Number of phases;
7) Mechanical output in kW;
8) Rated voltage;
9) Class of insulation;

---

*Specification for three-phase induction motors (*fourth revision*).

10) Speed in revolutions per minute, approximate, at the rated output;
11) Direction of rotation;
12) The maximum temperature of the cooling air in the place in which the motor is intended to work in ordinary service;
13) Maximum permissible temperature-rise of motor required, if different from this standard;
14) The altitude of the place in which the motor is intended to work in ordinary service, if it exceeds 1 000 m;
15) If a motor is required to operate between various limits of voltage, current, frequency or speed, the corresponding value of the voltage, current, frequency and speed, respectively;
16) System of earthing, if any, to be adopted;
17) Particulars of tests required and where they are to be carried out;
18) Details of shaft extension required;
19) Method of starting to be employed;
20) Breakaway torque in terms of the rated-load torque and the corresponding breakaway starting current which may be taken from the supply with the starting apparatus in circuit;
21) Nature of load and any information regarding the driven machine which has a bearing upon the torque required during the accelerating period, the kinetic energy of the moving parts to be accelerated, and the number of starts during a specified period;
22) a) Mounting details, and
    b) Details of drive, such as belt or gear or clutch;
23) a) Particulars of cable connections required, and
    b) Direction of cable entry;
24) Speed-torque characteristics of the spinning frame;
25) Provision for PTC thermisters, if desired; and
26) Any specific requirement.

Attention is directed to the duty rating of direct-on-line motor starters as specified in IS : 8544 (Part I)-1977*.

---

*Specification for motor starters for voltages not exceeding 1 000 V: Part I Direct-on-line ac starters.

APPENDIX B

(*Clause* 18.3.1.1)

FORM FOR TYPE TEST REPORT OF THREE-PHASE INDUCTION MOTOR (SQUIRREL CAGE)

Name and Address of the Manufacturer

As per IS : 2972 (Part III)-1979

Purchaser..........................

Certificate No. ....

Purchaser's Order No. ....

Order Acceptance No. ....

Nameplate Data

OUTPUT kW	SYNCHRONOUS SPEED rev/min	FULL LOAD rev/min	PHASE CONNECTION	Hz	VOLTS	AMPS FULL LOAD	ENCLOSURE	RATING	FRAME	TEMPERATURE RISE	CLASS OF INSULATION

Test Characteristics

LOADING CONDITION	VOLTS	AMPERES	WATTS	PERCENT SLIP	LOAD	POWER FACTOR		EFFICIENCY	
						Guaranteed	Test	Guaranteed	Test
No Load					—				
					1/2				
Load					$\frac{3}{4}$				
					$\frac{1}{1}$				

Temperature — Test Run

CONDITION OF TEST						TEMPERATURE RISE °C, STATOR	
Hours Run	Line Volts	Line Amperes	Watts Input	Calculated Output	Cooling Air Temperature °C	Core by Thermometer	Windings by Resistance or Thermometer

Breakaway Torque and Breakaway Starting Current			Insulation and High-Voltage Test	
Breakaway Starting Torque in Nm with.................. Volts Applied	Breakaway Starting Current (Locked Rotor) with Volts Applied	Input in Watts with........Volts Applied	Insulation	High Voltage

Resistance of Stator Winding per Phase.........ohms at.........°C

The motor runs up to full load speed at no-load in both directions of rotation with............... ......volts applied to stator.

Momentary overload for 15 seconds....................test O.K.

Approved by................

Tests conducted on motor No. ....

Date.........................

Tested by ....

(*Continued from page* 2)

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Shri Dhruv M. Naik	All India Electric Motor Manufacturers' Association, Bombay
Shri M. J. Naik (*Alternate*)	
Shri J. M. Naik	Millowners' Association, Bombay
Shri E. N. Narayanaswamy	Directorate of Industries & Commerce, Government of Tamil Nadu, Madras
Shri C. Natarajan (*Alternate*)	
Shri N. C. Nayak	Hindustan Steel Ltd, Ranchi
Shri A. K. Ghosh (*Alternate*)	
Dr M. S. Padbidri	Hindustan Brown Boveri Ltd, Bombay
Shri Y. D. Dosaj (*Alternate*)	
Dr G. M. Phadke	Indian Electrical Manufacturers' Association, Bombay
Shri N. Ramajayam	Indian Machine Tool Manufacturers' Association, Bombay
Shri M. Rangashai	Hindustan Machine Tools Ltd, Bangalore
Kumari Nirmala Naik (*Alternate*)	
Shri M. K. Sibbal	Gautam Electric Motors Pvt Ltd, New Delhi
Shri A. N. Srivathsa	NGEF Ltd, Bangalore
Shri S. A. Wajid (*Alternate*)	

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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